Chapter 11 – HEALTH RISK COMMUNICATION: INTENDED AND UNINTENDED CONSEQUENCES OF BIOMONITORING

by

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11.1 ABSTRACT

The introduction of biomonitoring for assessment of troops' exposure to toxic hazards in operational environments will provide new opportunities to gain important answers and data on health hazards. At the same time, such monitoring may raise new concerns and trigger a need for communicating to troops why, how and for whose benefit the monitoring is conducted; properly communicated, explanations about biomonitoring may increase confidence that preventive medical measures are being taken and that there is genuine concern about protecting soldier health. The perception of risk and behavioural response is affected by the manner in which soldiers receive their information about biomonitoring efforts. This chapter attempts to stress, through a very brief overview, why some key factors such as risk perception, social amplification and risk communication, will be important issues to address, if a future use of biomonitoring is to be successfully implemented in operations, and how biomonitoring could, in turn, benefit from being made more easily understood and familiar to troops, relatives and the media. The chapter briefly discusses such concepts as the psychometric paradigm of risk perception and social amplification of risk, from an operational point of view, and what this may mean in the context of soldiers' perception for true or perceived toxic exposure. It comments on how soldiers' risk perception (and need for risk communication) may differ not only between troops and on an individual basis, but also due to other stress factors within the mission or home conditions, during and after a mission. Finally the chapter discusses how and why risk communication is essential when developing new techniques of biomonitoring for toxic hazards in operational environments.

11.2 SCOPE OF HEALTH RISK COMMUNICATION IN BIOMONITORING

Health risk communication, and health risk communication in military operational environments, is a science in itself, with worldwide growing knowledge on an academic as well as everyday operational level. Operational exposures issues are currently addressed, and new important understanding of troops' reactions to health topics gained [1 – 3].

This chapter makes no attempt to address the full complexity of the field. Our goal is to point out the need for the early introduction of risk communication aspects, into the fast development of new biotechnologies for the assessment of toxic hazards in operational environments.

Biotechnology, from a risk perception perspective, has been identified as one of the new technologies in which non-technical people today perceive many risks that may seem irrational to "experts." Additionally, the divergence in understanding and association of the meanings of words such as "exposure", "risk", "hazard" and "toxic" among lay people and experts [4] is of interest. Sampling and assessment for exposures have been applied during operations for a long time, resulting in routines designed to deliver not only

chemical data analysis, but to answer concerns among the soldiers such as; "…if they are monitoring, there has to be a hazard" or "…why are you only sampling in other camps, not in our units?" or "…now I feel sick - why can't I see the results?" In all, it's well known that monitoring and sampling in operations without efficient risk communication is likely to pose an additional burden and may introduce more stress in troops. Therefore, we must ask what particular challenges await, when introducing biomonitoring of troops in war, peace enforcing, or peacekeeping missions?

11.3 KEY RISK ISSUES, SOME EXAMPLES

How will a soldier operating in war or on peacekeeping missions perceive toxic hazards in theatre to which he or she might be exposed? The question is appropriate when discussing new biotechnologies, intending to provide a scientific answer to questions on toxic hazards and exposures among troops. In alerting soldiers to potential health risks through direct information (or indirectly signaling potential risks through monitoring), it is important to present accurate information about a credible health threat that properly arms the individual against the threat without inadvertently causing counterproductive behaviors such as panic (Figure 11-1). "Ebola virus" may provoke panic in civilian populations. In contrast, properly informed and prepared soldiers should be well able to defend themselves against Ebola virus, without adopting a careless or cavalier attitude towards a deadly threat, but also with confidence that this is a fully manageable disease threat.

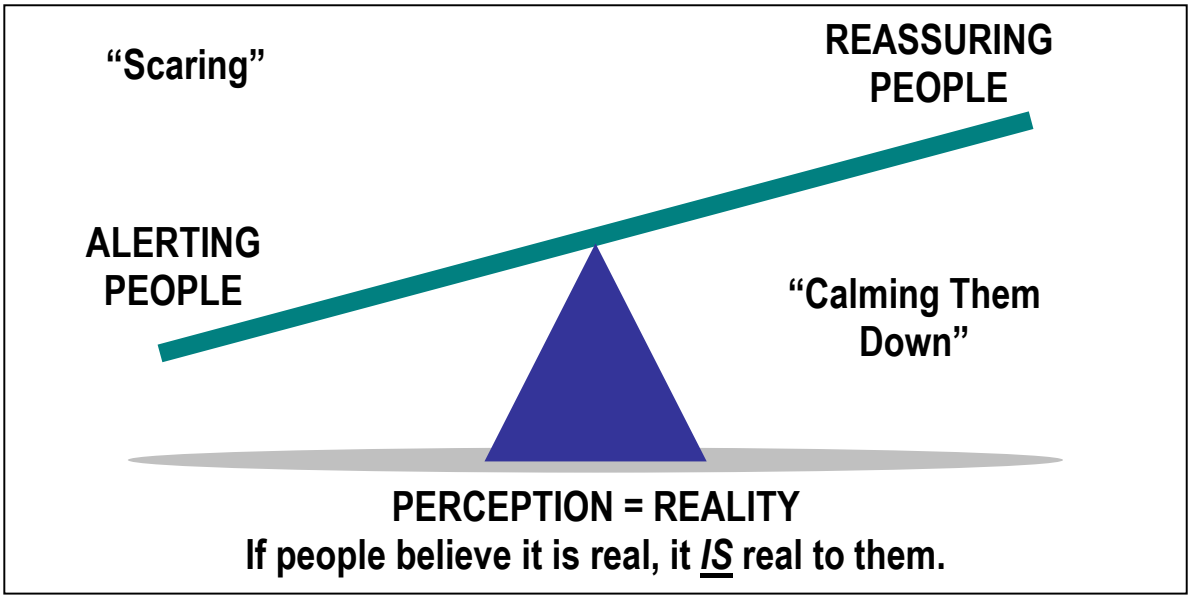

Figure 11-1: There is a Fine Balance in Health Risk Communication Between Providing Accurate Information that Prepares Soldiers Against a Health Risk and Causing Counterproductive Emotional Behaviors. It is important to get this right because the perceived message becomes reality.

Despite a scientific approach, where the risk can be calculated as a mathematical outcome of likelihood and consequences, there may be a difference between the predictable risk and the perception of risk – perceptions, not science, will take precedence in the behavioural outcomes. Current authorities in the field of Force Health Protection maintain that "*there is no such thing as an "objective risk*" [5] and that "*perception equals reality"*[6]. Thus, not only physical exposure, but anxiety about a perceived exposure, and the costs for military forces or society to address them, are highlighted in some recent deployment health issues including

Gulf War Syndrome, post traumatic stress disorders (PTSD), depleted uranium (DU) or Severe Acute Respiratory Syndrome (SARS).

Is this respect a few comments can be made on:

a) The psychometric paradigm (key factors in risk perception);

b) Social amplification of risk; and

c) Health risk communication.

11.3.1 The Psychometric Paradigm – Operational Aspects

11.3.1.1 Key Factors in the Psychometric Paradigm

Why do deployment operations attract more media coverage due to rumours of troops' potential or perceived exposure to a toxic substance, than does reporting the lethal outcome of traffic accidents – one of the highest non-battle causes of death in world wide operations? What risks are troops willing to take, as a part of their mission? And how do these questions interact with those surrounding biomonitoring? Risk means different things to different people, and wide variances are typical between "experts" and the lay public (or soldiers). The psychometric paradigm [7] identifies some significant key factors of concern in risk perception:

- Perceived controllability;
- Catastrophic potential;
- Dread;
- Unfamiliarity (strange odour, invisible, etc.);
- Perceived voluntariness of exposure;
- Who is affected?; and
- "Tampering with nature".

Biomonitoring in operations will address hazards that in many cases are unfamiliar to troops, and it can be noted that several of the key factors for risk perception are in the mainstream when addressing exposures of toxic hazards in operational environments, as well as new biotechnologies for the assessment of such exposures. From an exposure perspective, components such as "unfamiliarity" and "tampering with nature" are part of a spectrum that has recently been described in "The spectrum of threats" by NATO/EAPC in the new draft policy on Environmental and Industrial Health Hazards (EIHH)[8], as depicted in Figure 11-2.

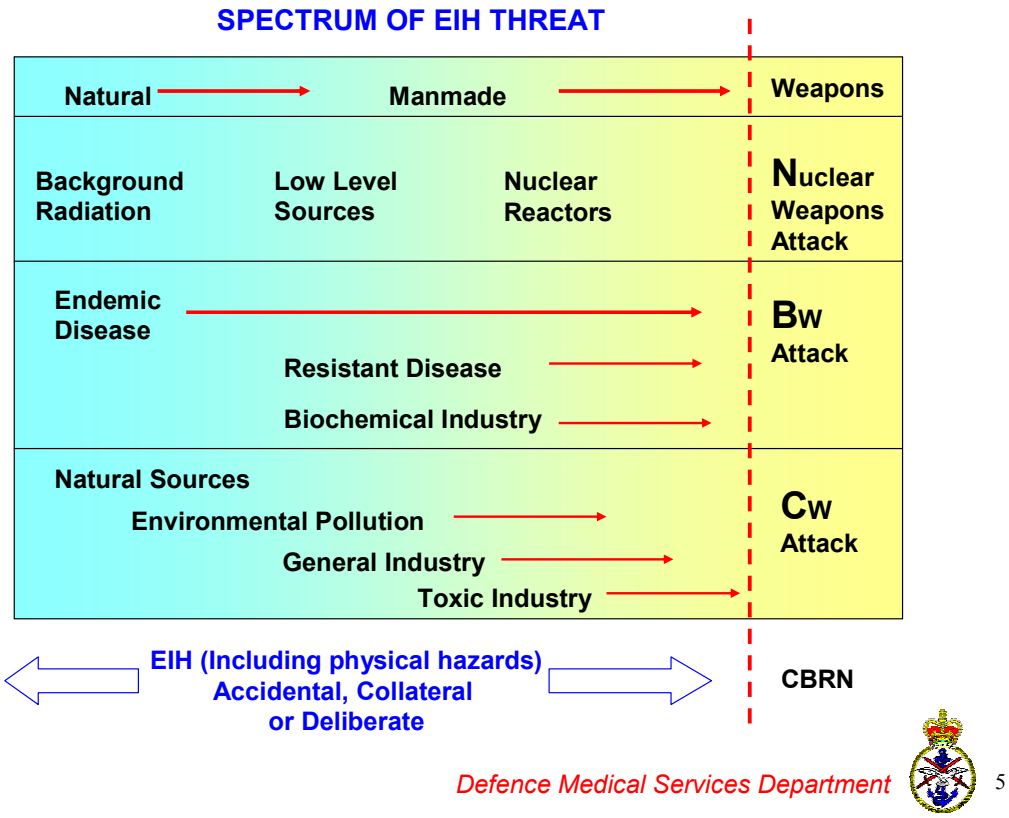

Figure 11-2: Spectrum of Environmental and Industrial Health Threats.

11.3.1.2 Motivation – One Brick in the Foundation of Risk Perception and Exposure Resistance

The psychometric paradigm also highlights the issue of perceived voluntariness of exposure [9]. In this context it is interesting to address the reported data on Motivation and Self-Image from deploying troops. How voluntary do they regard their participation to the mission and its potential hazards? Several studies have sought the key motivation for deploying to international operations among drafted soldiers and conscripts. One study of German troops [10] reported that 64% of troops regard themselves in the category "helper in Uniform," 22% as "leader and Education," 6% as "Careerist," 5% as "Martial Adventurer," and 3% as "Male Warrior." The main motivating factors among 1238 peacekeepers in Swedish UN battalions in BiH were identified to be military challenge, private financial reasons, sensation seeking or humanitarian and altruistic will [11]. Motivation among Austrian conscripts serving on the Golan Heights and in BiH 1996 – 97 [12] and among Norwegian peacekeepers serving in Lebanon (1978 – 1991) [13] was identified to be mainly associated with "high pay" and the chance to experience "adventures".

11.3.1.3 Trust in Commander and Experts – Who do Soldiers Listen to?

Research indicates that social trust of those who manage a hazard is strongly correlated to judgments about the hazard's risk and benefits [14]. Furthermore it is suggested that the lay public relies on social trust when making judgments of risks and benefits, when personal knowledge about a hazard is lacking. Troops are likely to have personal experience regarding operational DNBI (disease and non battle injurious) hazards such as traffic accidents, smoking hazards, malaria, heat stress and injuries resulting from physical training, whereas exposures to toxic hazards may be regarded as more unfamiliar – thus calling for a need to rely on social,

rather than personal, risk assessments. For this reason, trust in the chain of command, and commanders' preparedness to be able to support troops in a trustworthy manner, on matters of exposures to toxic hazards and potential biomonitoring is of special concern. Soldiers may become complacent in protection against hazards that are generally familiar, while unfamiliar hazards carry a high risk for suspicion and over-reaction. These extremes have to be countered in effective health risk communication.

The importance of a favourable relationship with peers and commanders for an increased likelihood of a satisfactory overall evaluation of the service period has been identified in several studies on soldiers in combat situations [15 – 17] as well as peacekeeping missions [18]. This will not only be important in soldiers' potential for social amplification of risk perception in general, but will also lay an important foundation when addressing the issue of toxic hazards and potential biomonitoring on operations.

In practice, experiences from theatre have showed that troops will rely more on the message passed by well-informed and trusted commanders rather than by experts [19, 20]. On the other hand, if a commander has not gained the trust of his/her troops, suspicion of biases, contradicting agendas and lack of concern will hamper risk communication, and experts may be regarded as more neutral actors. It may be important, from a biomonitoring view, that soldiers' view of risks in general and "acceptance" of exposures to toxic hazards, may differ severely depending of motivation and trust in the chain of command. Therefore, introduction and conduct of biomonitoring studies must be made with an understanding that unmotivated troops may be more sensitive with respect to the need for risk communication.

Experts also have responsibility for conveying health risk information to commanders with appropriate confidence levels, caveats, and a balanced perspective on the state of the knowledge; commanders make operational decisions that will be influenced by this information, but only if they also have confidence in their experts. In fact, scientific predictions can be wrong since these are only "best available" solutions to problems with real world complexities, usually extrapolated from highly controlled laboratory experiments or previous experience (e.g. epidemiological associations). Wrong predictions delivered with a high degree of certainty obviously contribute to health risk communication problems with the rapid erosion of credibility.

11.3.2 Social Amplification of Risk

11.3.2.1 Introduction

Events pertaining to hazards interact with psychological, social, institutional and cultural processes in a way that can amplify or attenuate perceptions of risk and shape risk behaviour [21]. The media plays a significant institutional role in amplifying or attenuating risk perception through decisions on what to report and how. Other sources of information such as the internet can have enormous significance and include unique opportunities for deliberate misinformation by an enemy. Troops are subjected to different types of stress during the mission cycle, also including post mission life. Mission-related toxic hazards and exposure or perceived exposure to such hazards may play an important role in the process of social amplification and actually promote stress. Furthermore, experience shows that perception of toxic exposure may spread very rapidly among troops, resulting in every-day expressions as "chemical epidemic" in theatre [22]. Biomonitoring, with its potential to provide a broad spectrum of chemical data analysis, may be looked upon as a potential "answer" to problems it was never intended to address.

11.3.2.2 Toxic Hazards, Stress and Social Amplification of Risks

As discussed in Chapters 9 and 10, an exposure situation (whether physical or perceived), should be placed into its mission lifetime context, and into the overall stress load. Tasks and situations of danger and/or combat

may differ significantly between different missions as well as during the mission cycle. Disregarding obvious individual differences, it is not unusual for soldiers in peacekeeping missions to describe less dangerous periods as "less positive"[23]. Furthermore, it has been discussed that it does not always seem to be the exposure to life-threatening events in itself that is the main stressor, but the conflict between strong aggressive impulses seeking an outlet and the inability to express them [24]. In other words, operational stressors overlaying toxic threats may include both external challenges and internal psychological conflicts. These latter stressors have become more significant in new peacekeeping roles for soldiers where they may be limited in their permissible responses.

Operational experiences during the past decade have shown that exposure, or perceived exposures, to toxic hazards may often serve as a "carrier" or amplifier for soldiers' frustration and stress levels [22]. During mission phases when activity rate is low, health concerns are likely to be raised [25], and concerns about potential health hazards linked to sometimes less expected issues such as bottled water, high-voltage lines, and distant ambient pollution (visible, but not necessarily with exposure routes that might affect troops) become a point of discussion [26].

The importance of a stable social network at home, as well as mutual respect with the chain of command, for the wellbeing of the soldier has been addressed in numerous studies. In all, there seem to be minor or no differences among soldiers from a professional military force, or a force of volunteers, regarding a positive outcome from a strong family support, good relations with commanders and peers (unit cohesion), and a certain degree of exposure to stressful events. This key factor for the soldiers' wellbeing may be related to post-mission stress reactions and, if a person perceives that the mission has directly or indirectly given rise to family problems or breakups, the individual may associate stress reactions with incidents (or exposures) that took place during the mission, rather than being properly attributed to a stressful private situation [27]. The similarity between diffuse symptoms of individual stress and some toxic exposures may add to a complex picture. For this reason studies evaluating potential chemical or other exposure effects today try to include the individual social situation, and great efforts are being made to include this factor in different deployment and post deployment questionnaires. The importance of family relationships and support in soldier health and performance is better recognized today than in the past, and it has gained greater importance for some armies today which have increasing proportions of married soldiers. Family and unit cohesion can, in turn, be affected by individual soldier deployment exposures. The importance of toxic chemical exposures, traumatic stress conditions, and other injurious exposures such as mild traumatic brain injury (mTBI) to changes in a soldier's mood (e.g. rages, depression) and behaviour is now beginning to be appreciated [28 – 30]. The potential interactions of these three components, each of which are important in current deployments, is completely unknown – but there is increasing public awareness of these threats and a growing need to clearly explain the known and suspected health consequences.

From this perspective, it may be discussed if and how individuals or groups that have been subjected to biomonitoring (or excluded from such a monitoring) and later perceive severe post deployment stress reactions, or even PTSD, will have an interest in results and an analytical outcome from the bio sampling. This highlights the need for preparation of honest risk communication addressing, among others, the four criteria proposed by the WHO before considering screening a population:

- Only screen for diseases that are common and/or may result in great suffering for the individual;
- Only screen when diagnostic methods are sensitive enough to identify a disease but specific enough to exclude the disease among healthy or exclude false positives;
- Only screen when there is an efficient treatment that can reduce the suffering; and

- Finally, there is a need for a cost-benefit analysis, not only financial, but including potential physical and/or psychological unease due to the screening procedure [31].

Intermediate screening approaches that detect changes in markers of effect that are not necessarily strong predictors of a specific disease outcome but which indicate a change in response to deployment are problematic and may, in themselves, compromise wellness. Thresholds of action for new measurable biomarkers may not be readily determined after the fact, when health monitoring may be confused with validation of an association between biomarker and outcome (e.g. detectable urine uranium after depleted uranium exposure). Necessary epidemiological research must be carefully explained to commanders and soldiers so that everyone has realistic expectations in advance of the reporting of results.

11.3.2.3 Media

The media coverage of the development of events in a mission area tends to be important to the deployed soldiers as well as to the relatives at home [32]. While news coverage is normally high during the early deployment phases, it tends to diminish during a long term ongoing mission. This may change rapidly, in the event of an exposure or perceived exposure situation in the mission, such as a focus on depleted uranium, rumours of "faecal dust" (Afghanistan) [33], and fear of lead exposure Mitrovica, Kosovo [34]. Returning to the "Spectrum of Threat" (Figure 11-2) it may be noted that media coverage tends to increase the further the exposure is perceived to be to the right of the figure (i.e. towards manmade warfare agents). A decision to introduce biomonitoring among troops, or some of them, is not unlikely to become a news event of interest for the media, raising questions about a presumed, maybe unknown, health risk for the soldiers. Following the first Gulf War experience, the public focus has been in the opposite direction for the U.S., with questions raised about why there is not more biomonitoring and health surveillance of deployed soldiers, with an unrealistic expectation that everything about a soldier's health status will be explained by measurements conducted using serum samples taken before and after a deployment.

Media reports clearly affect the public perceptions of reality. Every time a new national announcement occurred concerning Gulf War Illnesses in the U.S., there was a surge in new enrollments to the DoD Gulf War health registry from service members concerned about their health (Figure 11-3). The most notable spikes followed news about neurotoxic chemical threats, including discussion about DEET and low-level sarin exposures and the hypothesized associated health risks.

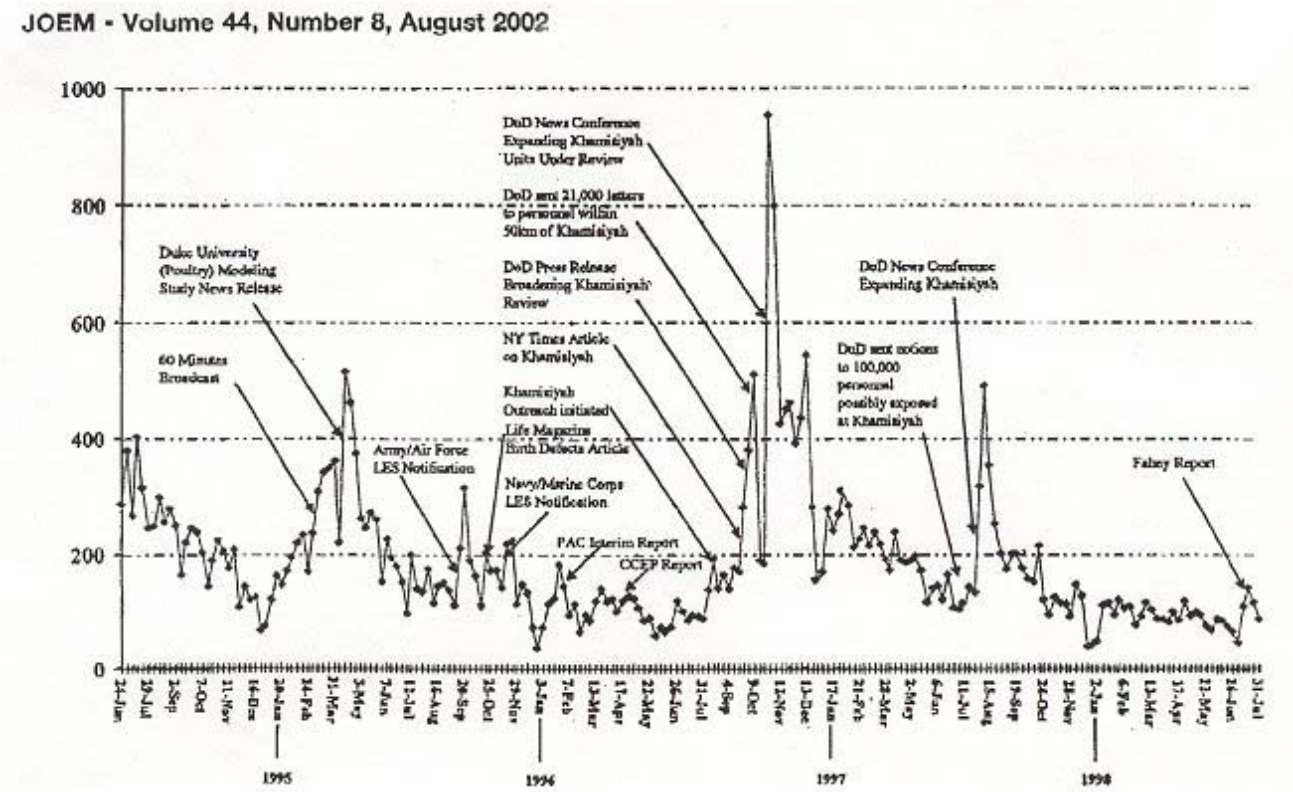

Figure 11-3: New Enrollments to the Gulf War Health Registry in Relationship to DoD News Releases and Reports between June 1994 and July 1998 (from [35]).

11.4 HEALTH RISK COMMUNICATION AND BIOMONITORING

The fast developing technique of biomonitoring and biomarkers has provided a new perspective on exposure assessments. Recent biomonitoring studies have examined the levels of 200 chemicals. However, biomonitoring data, by themselves, are not very useful in helping consumers (soldiers or relatives) to understand their individual health risk [36]. A major challenge facing those who conduct biomonitoring programs is how to best communicate the information to the troops.

Will troops trust the health risk communication provided? In this context, there are well-known factors of certain concern when discussing the need for communication on exposure and biomonitoring with deploying troops. Risk judgments need to address [37] the concern among troops that “experts” may be biased, “experts” may be motivated by self-serving interests and values, “expert” risk judgments are not absolute and that “lay” risk judgments should not be discounted. In the end, what risks are deemed “tolerable” or “acceptable” will depend on how those involved view the data upon which the risk measure is based, and whose values are considered. Some aspects are discussed below.

The purpose of biomonitoring and the methods described in this report is to serve as one of many tools in the battle to ensure the health of deploying troops. The benefits, from a medical and scientific point of view are many: an increased possibility to evaluate and compare the health status of a soldier before and after deployment; an increased possibility to measure effects on an individual basis, rather than estimate potential

individual exposure rate from ambient monitoring; and not least, the potential for gathering objective data in numeric form which could facilitate statistical evaluations that will improve the scientific knowledge on true exposure rates during deployments, thus creating a sound base for future preventive medicine activities.

At the same time, the complexity of health status, stress factors, neurobehavioral effects and exposure rates discussed in this report is well known. The evaluation and transforming of biomonitoring data into assessed individual health impacts, must thus be set into its true context, if the goal is to address exposure incidents during deployments. Deployed personnel can be expected to respond differently to an exposure incident, depending not only on genetic and physiological sensibility, but also on mental factors such as expectations, motivations, trust in command, and relation to mission task.

Furthermore, toxic exposure monitoring in general, and biomonitoring in particular, may induce stress in troops well as in relatives at home, if not conducted with rigorous risk communication. In response to questions raised about post deployment illnesses after the first Gulf War in 1991, the U.S. DoD invested substantial resources into a thorough series of investigations, reviews, and information exchanges, providing a comprehensive health risk communication program that has become a model for how deployment toxicology issues should be addressed [38].

Key factors for success in communicating exposure hazards with troops, are well known [25], and biomonitoring for exposure among deploying troops will highlight key factors such as the need for:

- Trust in command;
- Trust in experts;
- Belief in the mission;
- Long-term follow up on risk communication after mission;
- Information *sharing* – not top down!;
- Trust in new techniques and, above all;
- The realisation that *a perceived risk will become a true risk.*

Information should be shared with respect to the fact that troops are likely to find the new technology of biomonitoring, and the toxic hazards it's intended to address, unfamiliar, and thus look for sound, practical and robust ways:

- To reduce fears of:
  - The unknown,
  - Spectacular rather than common death, and
  - Invisible threats and threats rather than those associated with strange odours;
- To encourage the disappearance between lay people and experts in their perception of the meaning of words such as; "toxic", "risk" " hazard", etc.; and
- To recognise the importance of toxic hazards as "carriers" for stress factors.

With early risk communication and information sharing, amongst not only troops, but with the chain of command, relatives and not least the media, some of the challenges for biomonitoring as a tool in preventive health may be overcome.

The chapter has been written with acknowledgement to LtCol Ken Roberts, Army Military Directorate, UK, Dr Lori Geckle USACHPPM, USA, and Anne Kari Rom, Senior Advisor, Norwegian Army.

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